

FORM PTO-1390
(REV 12-29-99)

U.S. DEPARTMENT OF COMMERCE PATENT AND TRADEMARK OFFICE

ATTORNEY'S DOCKET NUMBER

**TRANSMITTAL LETTER TO THE UNITED STATES
DESIGNATED/ELECTED OFFICE (DO/EO/US)
CONCERNING A FILING UNDER 35 U.S.C. 371**

41496

U.S. APPLICATION NO. (if known, see 37 CFR 1.5)

09/830214INTERNATIONAL APPLICATION NO.
PCT/EP99/08402INTERNATIONAL FILING DATE
November 3, 1999PRIORITY DATE CLAIMED
November 4, 1998

TITLE OF INVENTION DEVICE FOR CONVERTING ELECTRIC ENERGY INTO A MECHANICAL ONE AND/OR FOR DOING
THE OPPOSITE AND METHOD FOR PRODUCING SUCH A DEVICE

APPLICANT(S) FOR DO/EO/US
ERICH WALTER FRANK

Applicant herewith submits to the United States Designated/Elected Office (DO/EO/US) the following items and other information:

1. ☒ This is a **FIRST** submission of items concerning a filing under 35 U.S.C. 371.
2. ☐ This is a **SECOND** or **SUBSEQUENT** submission of items concerning a filing under 35 U.S.C. 371.
3. ☐ This express request to begin national examination procedures (35 U.S.C. 371(f)) at any time rather than delay examination until the expiration of the applicable time limit set in 35 U.S.C. 371(b) and PCT Articles 22 and 39(1).
4. ☒ A proper Demand for International Preliminary Examination was made by the 19th month from the earliest claimed priority date.
5. ☒ A copy of the International Application as filed (35 U.S.C. 371(c)(2))
 - a. ☒ is transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ has been transmitted by the International Bureau.
 - c. ☐ is not required, as the application was filed in the United States Receiving Office (RO/US).
6. ☒ A translation of the International Application into English (35 U.S.C. 371(c)(2)).
7. ☒ Amendments to the claims of the International Application under PCT Article 19 (35 U.S.C. 371(c)(3))
 - a. ☐ are transmitted herewith (required only if not transmitted by the International Bureau).
 - b. ☐ have been transmitted by the International Bureau.
 - c. ☐ have not been made; however, the time limit for making such amendments has NOT expired.
 - d. ☒ have not been made and will not be made.
8. ☐ A translation of the amendments to the claims under PCT Article 19 (35 U.S.C. 371(c)(3)).
9. ☒ An oath or declaration of the inventor(s) (35 U.S.C. 371(c)(4)).
10. ☒ A translation of the annexes to the International Preliminary Examination Report under PCT Article 36 (35 U.S.C. 371(c)(5)).

Items 11. to 16. below concern document(s) or information included:

11. ☒ An Information Disclosure Statement under 37 CFR 1.97 and 1.98.
12. ☒ An assignment document for recording. A separate cover sheet in compliance with 37 CFR 3.28 and 3.31 is included.
13. ☒ A FIRST preliminary amendment.
☐ A SECOND or SUBSEQUENT preliminary amendment.
14. ☐ A substitute specification.
15. ☐ A change of power of attorney and/or address letter.
16. ☒ Other items or information:
Translation of Preliminary Examination Report



Form PTO-1390 (REV 12-29-99) page 2 of 2

41496

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

In re Application of	:	
	:	
ERICH WALTER FRANK	:	PATENT
	:	
Serial No.: NEW	:	Group Art Unit:
	:	
Filed: Herewith	:	Examiner:
	:	
For: DEVICE FOR CONVERTING ELECTRIC	:	
ENERGY INTO A MECHANICAL ONE	:	
AND/OR FOR DOING THE OPPOSITE	:	
AND METHOD FOR PRODUCING	:	
SUCH A DEVICE	:	

PRELIMINARY AMENDMENT

Commissioner for Patents
Washington, D.C. 20231

Sir:

Preliminary to examination and calculation of the filing fee, please amend the above-identified application, as amended in Preliminary Examination, as follows:

In the Claims

3. (Amended) Device as in claim 1, characterized in that the connection distributors (8, 9, 10) have a cutting/clamping device (21'; 121) configured of one piece for the electric connection with the associated winding ends (17a, 17b; 18a, 18b; 19a, 19b).

4. (Amended) Device as in claim 1, characterized in that the two bands (8a, 8b; 9a, 9b; 10a, 10b) run essentially in semi-circles in circumferential direction.

TELETYPE UNIT

5. (Amended) Device as in claim 1, characterized in that the two bands (110a, 110b) in the mechanical sleeve or bearing area (114) are connected by an elastic or flexible element, preferably by a corrugated retaining ring (124).

6. (Amended) Device as in claim 1, characterized in that the bands (8a, 8b; 9a, 9b; 10a, 10b) of the individual groups of connections are arranged axially one behind the other, or are of different diameters and are arranged concentrically radially one behind the other.

7. (Amended) Device as in claim 1, characterized in that the connection distributors (8, 9, 10) are arranged electrically insulated from one another in a receiving means (7) of the connection device (7, 8, 9, 10) which can be axially and/or radially securely mounted on the rotor (4) and/or the stator (2).

8. (Amended) Method for producing a device as in claim 1, with the following steps:
- embedding of the electrically conductive bands (8a, 8b; 9a, 9b; 10a, 10b) of the connection distributors (8, 9, 10) in a receiving means (7) of the connection device (7, 8, 9, 10) in such a manner that the connection distributors (8, 9, 10) not belonging to a common group of connections are electrically insulated from one another,
 - tight fastening of the connection device (7, 8, 9, 10) to the rotor (4) and/or the stator (2),
 - electric connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) with the associated connection distributors (8, 9, 10), and
 - forming in turn of a plug bushing (14; 15; 16) of the connection device of one piece out of the bands (8a, 8b; 9a, 9b; 10a, 10b) guided in one piece to the exterior of the device, these bands being part of a group of connections for the electric contacting of the relevant group of connections to the exterior of the device.


10. (Amended) Method as in claim 8, characterized in that the receiving means (7) are sealed together with the embedded connection distributors (8, 9, 10), preferably by dipping in an electrically insulating synthetic resin, whereby preferably following the sealing off, contact points are accessible on the connection distributors (8, 9, 10) for the electric connection with the winding ends (17a, 17b; 18a, 18b; 19a, 19b).

11. (Amended) Method as in claim 8, characterized in that the rotor (4) or the stator (2) together with the connection device (7, 8, 9, 10) sealed onto it and connected with the winding ends (17a, 17b; 18a, 18b; 19a, 19b) is then sealed off, preferably by dipping in an electrically insulating synthetic resin.

REMARKS

The above changes eliminate multiple dependency in the claims.

Respectfully submitted,


Mark S. Bicks
Reg. No. 28,770

Roylance, Abrams, Berdo & Goodman, L.L.P.
1300 19th Street, N.W.
Washington, D.C. 20036
(202) 659-9076

Dated: April 23, 2001

Marked-up original claims

-11-

Patent Claims

1. Device for converting electric energy into mechanical energy and/or vice versa with a rotor (4) and a stator (2), particularly a combined motor/generator device (1), wherein coil windings (6) having at least two winding ends (17a, 17b; 18a, 18b; 19a, 19b) are arranged on the rotor (4) and/or the stator (2) in turn having a circumferential layout direction (13) following one after the other, and the winding ends (17a, 17b; 18a, 18b; 19a, 19b) of the various coil windings (6a; 6b; 6c) are electrically connected with one another with formation of groups of connections, whereby the device includes a connection device (7, 8, 9, 10) for the connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) of a group of connections with electrically conductive connection distributors (8, 9, 10) running in circumferential direction, which form a connection device and are guided in one piece toward the exterior of the device, by means of which the relevant groups of connections can be electrically contacted outside the device, **characterized in that** the connection distributors (8, 9, 10) of each connection group have two electrically conductive bands (8a, 8b; 9a, 9b; 10a, 10b) which in turn are guided in one piece toward the exterior of the device and there together form a plug bushing (14; 15; 16) for the electric contacting of the relevant groups of connections.
2. Device as in Claim 1, characterized in that each winding end (17a, 17b; 18a, 18b; 19a, 19b) is connected with the associated connection distributor (8, 9, 10) in the close vicinity of the relevant coil winding (6a, 6b, 6c).
3. Device as in ~~one of the Claims 1 or 2~~ ^{Claim 1}, characterized in that the connection distributors (8,

MODIFIED PAGE

piece out of the bands (8a, 8b; 9a, 9b; 10a, 10b) guided in one piece to the exterior of the device, these bands being part of a group of connections for the electric contacting of the relevant group of connections to the exterior of the device.

9. Method as in Claim 8, characterized in that the electric connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) with the associated connection distributors (8, 9, 10) occurs in the close vicinity of the relevant coil winding (6a, 6b, 6c) by insertion in turn in a cutting/clamping device (21) provided on the connection distributors (8, 9, 10) and preferably of one piece, or by gluing, soldering or welding.
10. Method as in Claim 8 ~~or 9~~, characterized in that the receiving means (7) are sealed together with the embedded connection distributors (8, 9, 10), preferably by dipping in an electrically insulating synthetic resin, whereby preferably following the sealing off, contact points are accessible on the connection distributors (8, 9, 10) for the electric connection with the winding ends (17a, 17b; 18a, 18b; 19a, 19b).
11. Method as in Claim 8 ~~or 9~~, characterized in that the rotor (4) or the stator (2) together with the connection device (7, 8, 9, 10) sealed onto it and connected with the winding ends (17a, 17b; 18a, 18b; 19a, 19b) is then sealed off, preferably by dipping in an electrically insulating synthetic resin.

4/PR TS

09/830214
JC18 Rec'd PCT/PTO 24 APR 2001

DEVICE FOR CONVERTING ELECTRIC ENERGY INTO A MECHANICAL ONE
AND/OR FOR DOING THE OPPOSITE AND METHOD FOR PRODUCING SUCH A
DEVICE

The invention relates to a device for converting electric energy into mechanical energy and/or the opposite according to the disclosure part of Claim 1 as well as a method for producing such a device.

In known devices the ends of the windings which are the coil windings of the rotor and/or the stator stand at some acceptable distance over the coil windings and are guided in circumferential direction in relation to a common point. There, the relevant ends of the windings are pressed together with one another, thus forming groups of connections, and then are provided with an electrical connection element. This requires costly and essentially manually executable laying out of the winding ends and also increases the dimensions of the structure, since the winding ends must be guided over the coil windings. Also, the connection between the connection device and the pressed-on winding ends, especially under environmental conditions which generate reactions thereto, represents a possible source of breakdown during operation of the device which has been produced, for example because of corrosion of the contacts.

DE 195 44 830 A1 shows a stator for electric motors in which the winding ends of a connection group are connected with one another by electrically conducting connection distributors running in circumferential direction. The connection distributors have connection soldering lugs to which the winding ends or the motor connection conductors are welded or soldered.

US 5,806,169 shows a method for the production of an electric motor in which the stator is spray-injected and injection molded following the welding of the stator windings onto corresponding connection soldering lugs by means of an injection molding technique using a synthetic resin material.

The object of the invention is therefore to disclose a device to overcome the problem by using such a device, and an associated method of production of the device, which method and device overcome the drawbacks of the state of the art, particularly by incorporating small structural dimensions, high contact reliability and a long life, even under aggressive environmental conditions, and which can be manufactured simply.

The problem is solved by the device disclosed in Claim 1, as well as by the method which is also disclosed. Particular embodiments of the invention are disclosed in the dependent claims.

The device according to Claim 1 can be a motor or a generator, particularly a combined alternating- or direct current-powered motor/generator device. Thus, coil windings could be arranged both on the rotor and on the stator, corresponding to the number of poles found on the device. The switch connection of the individual winding ends occurs according to the invention by means of a connection device with formation of connection groups or contact groups. With a three-phase alternating current device, for example, three (delta-wound circuit), four (star-wound circuit with spread-out star) or six connection or contact groups are formed. With six groups of connections, a switchover from star operation to three-phase operation and vice versa can also occur outside the device by suitable switching of the groups of connections. The rotor can be running on the interior or on the exterior in relation to the stator. A rotor having identical mass but running on the exterior has greater moments of inertia and torque. The connection distributor

is guided toward the outside of the rotor or stator and there forms one piece with a connection device. This occurs preferably by suitable bending or shaping of a copper band or strip serving as connection distributor to a mechanical sleeve or bearing or plug element.

According to the particular embodiment disclosed in Claim 3, the winding ends could advantageously be quite short. This leads not only to savings of material but also to small structural dimensions for the entire device. In the case of a rotor winding the rotor then has a slight imbalance which is a condition of this the type of construction.

According to the particular embodiment as in Claim 4, the connection distributors which may be annular in construction have cutting/clamping devices of one integral piece on the corresponding points at which the winding ends can be embedded, whereby the winding insulation is cut through at those points upon the pressing in of the winding ends. The cutting/clamping device in turn is preferably arranged precisely in relation to the associated winding ends. The cutting/clamping device can be set up ready for use by corresponding provision of a copper strip or copper ring used as connection distributor.

The particular embodiment of Claim 5 provides essentially circular connection distributors, aligned coaxially with the stator/rotor axis. The special type of embodiment of Claim 6 as connection distributor preferably provides a copper band or strip, whereby the band or strip width is aligned parallel to the rotor or stator axis. According to Claim 7 two bands or strips are present for each connection group, which bands or strips are guided in one piece toward the exterior of the device and there form a mechanical sleeve or bearing area for a connection device by means of suitable semi-circular bending, whereby in the mechanical sleeve or bearing area the band or strip width is aligned parallel to the longitudinal axis of a plug element to be inserted

into the mechanical sleeve or bearing. According to Claim 8 the two bands in the mechanical sleeve or bearing area are secured flexibly by a flexible elastic element.

The special type of embodiment as in Claim 9 has an axial or radial arrangement of the connection distributors aligned one after the other, whereupon the radial or axial structural dimensions of the device can be minimized. The particulars with reference to radial and axial arrangement are then referenced to the rotary axis of the device.

According to the type of embodiment of Claim 10, not only is an electric insulation of the connection distributors from one another guaranteed by the receiving means but also, by the provision of positioning means, for example cams on the receiving means and notches on the associated connection distributor, an exact peripheral positioning of the connection distributor in relation to the receiving means and correspondingly in relation to the device can be guaranteed. Thus, minimal connection paths between the connection distributor and the coil winding are guaranteed simultaneously with simple assembly. Of course the connection distributors could also be fastened securely directly to the rotor and/or the stator without use of any receiving means.

With the method of the invention as in Claim 11, first of all the electrically conducting connection distributors are inserted into receiving means of the connection device, then the connection device fastened securely to the rotor or stator for example by bolting or pinning on, and then the winding ends electrically connected with the associated connection distributors. The connection distributors are guided in one integral piece along the exterior of the device and there form one connection device in turn for each connection group. These steps of the method could advantageously be made automatic and for example could be carried out by industrial

robots.

According to the type of embodiment disclosed in Claim 12, the winding ends can be connected with the associated connection distributors by means of a cutting/clamping device or by gluing, soldering or welding. Preferably high temperature-resistant electrically conductive adhesive substances are used for glue. Preferably the hard-soldering process is used for soldering. When using welding, spot-welding is preferred.

In the type of embodiment of Claim 13, the receiving means are sealed shut with the embedded connection distributors, if necessary with use of a clamp collar. This preferably occurs by dipping in an electrically insulating synthetic resin. Then contact points for the electric connection with the ends of the windings remain accessible on the connection distributors. Alternatively to that, the contact points of the connection distributor provided with a cutting/clamping device could also be cast or filled in, since during the pressing in of the winding ends the insulating layer is penetrated. This use of the procedure has the advantage that the connection device can be set up as a complete structural assembly in and of itself on the rotor or stator and can be completely assembled in one step.

According to the embodiment of Claim 14 the completely assembled and wired rotor or stator is cast in insulating material.

Other advantages, features and individual disclosures of the invention are disclosed by the dependent claims as well as the following description, in which a number of exemplary embodiments are described in some detail with reference to the attached drawings. Therefore the features mentioned in the claims and in the description could in turn be essential to the invention

in and of themselves or in any desired combination.

- Fig. 1 shows a cross section through a device according to the invention,
Fig. 2 shows a plan view of the stator of Fig. 1,
Fig. 3 shows the electric wiring of the coil windings,
Fig. 4 shows a section corresponding to the line IV-IV of Fig. 2,
Fig. 5 shows a section along the line V-V of Fig. 2,
Fig. 6 shows a cross section along the line VI-VI of Fig. 2,
Fig. 7 shows an alternative embodiment of the device,
Fig. 8 shows an enlarged section of Fig. 7 in the area of the connection distributors, and
Fig. 9 shows the view IX of the connection mechanical sleeve or bearing of Fig. 7. .

Fig. 1 shows a cross section through a device according to the invention. In this case it has to do with a combined motor/generator device 1 with an interior stator 2 and a rotor 4 running on the exterior around the axis 3. The traditional associated housing is not shown. On the tin-plated core 5 of stator 2 are wound in sequence coil windings 6 in circumferential alignment. The winding ends of the various coil windings are connected electrically with one another with formation of groups of connections, whereby a connection device 7, 8, 9, 10 includes connection distributors 8, 9, 10 running in circumferential alignment, which are inserted in receiving means which can be fastened and sealed onto rotor 2. Connection distributors 8, 9, 10 of each group of connections are formed in the present embodiment by two copper bands bent in approximately semi-circular shape, which are arranged one behind the other in radial direction 20 and are electrically insulated from one another. The copper bands are dimensioned to correspond to the electric currents to be supported, for example they are of a width x thickness of $15 \times 1 \text{ mm}^2$. Rotor 4 running on the exterior engages peripherally around the stator and supports permanent

magnets 12 on the surface 11 facing stator 2 in a number corresponding to the number of poles or the number of coil windings 6. Coil windings 6 if necessary can also have one or more symmetrically or unsymmetrically distributed partial taps.

Fig. 2 shows a plan view of the stator 2 of Fig. 1. Of the coil windings 6 arranged over the entire circumference in circumferential direction 13 there are represented for clarity only six coil windings 6a, 6b, 6c. The stator 2 which is represented is wired for a three-phase alternating current connection in a triangular circuit.

Coil windings 6a, 6b, 6c are thus wired each by means of approximately semi-circular connection distributors 8a, 8b; 9a, 9b; 10a, 10b to three connection groups and can be electrically connected from outside the stator by means of a first, second and third mechanical sleeve or bearing 14, 15, 16. The first winding end 17a of coil winding 6a of the first group of connections is connected with connection distributor 8b, whereas the second winding end 17b is connected with connection distributor 9b. The first winding end 18a of coil winding 6b of the second group of connections is connected with connection distributor 9b, whereas the second winding end 18b is connected with connection distributor 10b. The first winding end 19a of coil winding 6c of the third group of connections is connected with connection distributor 10b, and the second winding end 19b is connected with connection distributor 8b. And so forth, for the connection of the corresponding winding ends to connection distributors 8a, 8b, 8c. Both of the connection distributors 8a, 8b are formed in turn by copper strips which are bent approximately in semi-circles made up of one piece at one point of the circumference upward and/or outward and the corresponding ends are bent into formation of a mechanical sleeve or bearing area for an electric connection 14 of this connection group. Correspondingly the same is the case for the two connection distributors 9a, 9b, which in one piece form the connection 15 of the second

connection group, and for connection distributors 10a, 10b, which in one piece form the electric connection 16 of the third connection group.

Fig. 3 shows the electric wiring of the coil windings 6a., 6b, 6c of Fig. 2, arranged alternating in circumferential direction, which are connected parallel within the groups of connections which are formed and as a whole are wired to a three-phase, delta-wound circuit with the three electric connections 14, 15, 16. Insofar as a three-phase-star circuit is required, four connection groups altogether are provided, whereby the star point as needed can be guided over a fourth connection toward the outside of the stator or not. If the possibility of reversal from star- to delta-wound circuit and vice versa is to be present, the two winding ends of the parallel-connected coil windings in turn are to form contacts by connection distributors insulated from one another and are to lead to six electric connections in all.

Fig. 4 shows a section corresponding to line IV-IV of Fig. 2. The first end 18a of coil winding 6b wound on laminated core 5 is connected electrically with the middle of connection distributor 9a in radial direction 20 by means of a cutting/clamping device 21 configured in one piece therewith. With the pressing in of the insulated winding end 18a the insulation is penetrated by the cutting flank 21a and the electric contact between connection distributor 9a and winding end 18a is produced. With further pressing in of winding end 18a, the cutting off of the nearly flush winding wire occurs. In the area of the connection of winding end 18a to connection distributor 9a the connection distributor 8a on the exterior in radial direction 20 preferably has a notch, in order to guarantee an electrically insulated passage of winding end 18a to the middle of connection distributor 9a in radial direction 20. Alternatively or in supplement hereto, the exterior connection distributor 18a can also have a narrower strip width over its entire length and/or can be inserted more deeply into the receiving means 7, which for example is formed by a

plastic ring provided with grooves to receive said connection distributors 8a, 8b, 9a, 9b, 10a, 10b. Fig. 5 shows a section along line V-V of Fig. 2. Both of the approximately semi-circular connection distributors 9a, 9b according to Fig. 2 are bent radially outward in the area of section V-V in electric contact with one another. In the area of bringing together of the two connection distributors 9a, 9b, the exterior connection distributor 8a aligned in radial direction has a notch, so that connection distributor 9b can be guided past electrically insulated therefrom.

Fig. 6 shows a cross section along line VI-VI of Fig. 2. The two connection distributors 8a, 8b bent semi-circular at this point come in contact with one another on the circumference and are guided together toward the exterior of stator 2. By means for example of a not shown projection provided in the overlapping area, the projection on connection distributor 8a and a convexity provided at the corresponding point of connection distributor 8b, during the insertion and guiding together of the connection distributors 8a, 8b, a simple and precise positioning of connection distributors 8a, 8b in relation to receiving means 7 and in relation to one another is guaranteed. Instead of projection and convexity for example also a sort of groove/spring combination in the associated connection distributors 8a, 8b; 9a, 9b; 10a, 10b could be provided.

Fig. 7 shows an alternative embodiment of the device of the invention, whereby an interior stator 102 is again provided, this time with coil windings 106 -here shown only diagrammatically. The connection distributors 108, 109, 110 connected electrically with one another in this embodiment are arranged one behind the other in axial direction 122 parallel to the rotation axis 103 of the associated and not shown rotor and are electrically insulated from one another by receiving means 107. Fig. 8 shows a cutout enlargement of Fig. 7 in the area of connection distributors 108, 109, 110. Winding end 118a of coil winding 106b is electrically connected by means of the cutting/clamping device 121 with the center of connection distributor 109 in axial direction 122.

Fig. 9 shows the view IX of the mechanical sleeve or bearing 116 of the connection of Fig. 7. The two upward bent ends 110a, 110b of connection distributor 110 are bent in the contact area complementarily and symmetrically to the symmetry plane 123 perpendicular to the plane of viewing, symmetry plane 123 being bent in a semi-circle in order to be able to receive a contact pin. The ends of connection distributors 110a, 110b are secured flexibly in the mechanical sleeve or bearing area by means of a corrugated retaining ring 124.

Patent Claims

1. Device for converting electric energy into mechanical energy and/or vice versa with a rotor (4) and a stator (2), particularly a combined motor/generator device (1), wherein coil windings (6) having at least two winding ends (17a, 17b; 18a, 18b; 19a, 19b) are arranged on the rotor (4) and/or the stator (2) in turn having a circumferential layout direction (13) following one after the other, and the winding ends (17a, 17b; 18a, 18b; 19a, 19b) of the various coil windings (6a; 6b; 6c) are electrically connected with one another with formation of groups of connections, whereby the device includes a connection device (7, 8, 9, 10) for the connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) of a group of connections with electrically conductive connection distributors (8, 9, 10) running in circumferential direction, **characterized in that** the connection distributors (8, 9, 10) are of one integral piece and are guided toward the exterior of the device and in turn form a connection device (14, 15, 16), and that the groups of connections can be electrically contacted through the connection devices (14, 15, 16) on the exterior of the device.
2. Device as in Claim 1, characterized in that the connection distributors (8, 9, 10) form a mechanical sleeve or bearing or plug element outside the device.
3. Device as in Claim 1 or 2, characterized in that each winding end (17a, 17b; 18a, 18b; 19a, 19b) is connected with the associated connection distributor (8, 9, 10) in the close

vicinity of the relevant coil winding (6a, 6b, 6c).

4. Device as in one of the Claims 1 to 3, characterized in that the connection distributors (8, 9, 10) have a cutting/clamping device (21; 121) configured of one integral piece with the associated winding ends (17a, 17b; 18a, 18b; 19a, 19b) for the electric connection.
5. Device as in one of the Claims 1 to 4, characterized in that the connection distributors (8, 9, 10) for each connection group include an electrically conductive ring (108, 109, 111).
6. Device as in one of the Claims 1 to 4, characterized in that the connection distributors (8, 9, 10) for each connection group have at least one electrically conductive band (8a, 8b; 9a, 9b; 10a, 10b), which runs in its lengthwise direction at least in phases or stages and at least partially in a circle in circumferential direction (13).
7. Device as in Claim 6, characterized in that the connection distributors (8, 9, 10) for each connection group have two essentially semi-circular bands (8a, 8b; 9a, 9b; 10a, 10b) running in circumferential direction, which in turn are guided in one integral piece toward the exterior of the device and there together form a mechanical sleeve or bearing area for a connection device (14, 15, 16).
8. Device as in Claim 7, characterized in that the two bands (110a, 110b) in the mechanical sleeve or bearing area (114) are connected by an elastic or flexible element, preferably by a corrugated retaining ring (124).
9. Device as in one of the Claims 5 to 8, characterized in that for the individual connection groups appropriate rings (108, 109, 110) or bands (8a, 8b; 9a, 9b; 10a, 10b) are arranged axially one following the other or they have different diameters and are arranged concentrically radially one behind the other.
10. Device as in one of the Claims 1 to 9, characterized in that the connection distributors (8, 9, 10) are arranged electrically insulated from one another in a receiving means (7) of the connection device (7, 8, 9, 10) which can be axially or radially securely mounted on the

rotor (4) and/or stator (2).

11. Method for producing a device as in one of the Claims 1 to 10, with the following steps :
 - Embedding of the connection distributors (8, 9, 10) in a receiving means (7) of the connection device (7, 8, 9, 10) in such a manner that the connection distributors (8, 9, 10) not belonging to one common connection group are electrically insulated from one another,
 - Tight fastening of the connection device (7, 8, 9, 10) to the rotor (4) and/or the stator (2),
 - Electric connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) with the associated connection distributors (8, 9, 10), and
 - Forming of a connection device (14, 15, 16) of the connection distributors (8, 9, 10) made up of one integral piece and guided toward the exterior, for the electric contacting of the connection groups to the exterior of the device.
12. Method as in Claim 11 or 12, characterized in that the electric connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) with the associated connection distributors (8, 9, 10) occurs in the close vicinity of the relevant coil winding (6a, 6b, 6c) by insertion in turn in a cutting/clamping device (21) provided on the connection distributors (8, 9, 10) and preferably of one piece, or by gluing, soldering or welding.
13. Method as in Claim 11 or 12, characterized in that the receiving means (7) are sealed shut with the embedded connection distributors (8, 9, 10), preferably by dipping into an electrically insulating synthetic resin, whereby preferably following the sealed closing off, contact points are accessible on the connection distributors (8, 9, 10) for the electric connection with the winding ends (17a., 17b; 18a, 18b; 19a, 19b).
14. Method as in Claim 11 or 12, characterized in that the rotor (4) or the stator (2) together with the connection device (7, 8, 9, 10) sealed onto it and connected with the winding

**PATENT COOPERATION TREATY
CONCERNING INTELLECTUAL PROPERTY**

PCT

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(Article 36 and Rule 70 PCT)

Identification of Applicant or Representative: 10rrp/128515

International File Number: PCT/EP99/08402

International Application Date: 3 November 1990

Priority Date: 4 November 1998

FURTHER: See Notification concerning the Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416)

International Patent Classification or National Classification and IPK:

H02K3/52

Applicant: PFISTERER KONTAKTSYSTEME GMBH & CO.KG et al.

1. 1. This international preliminary examination report has been drawn up by the authority empowered with the international preliminary examination and is to be delivered to the Applicant according to Article 36.
 2. This REPORT includes a total of 5 pages including this cover sheet.
- /X/ ATTACHMENTS accompany the report; thus pages including descriptions, claims and/or drawings which have been modified and are basic component parts of this report, and/or pages containing reports delivered to this authority which are involved (see Rule 70.16 and paragraph 607 of the administrations' instructions for the PCT).

These attachments include a total of 11 pages.

3. This report includes data relating to the following points:

I	/X/	Basis for the report
II	//	Priority
III	//	No presentation of an expert opinion concerning novelty, inventive concept and commercial applicability
IV	//	Lack of clarity of the invention
V	/X/	Substantiated determination according to Article 35(2) relating to the novelty, the inventive concept and the commercial applicability; data and explanations for support of this determination
VI	//	Certain additional data
VII	//	Certain problems regarding the international application
VIII	//	Certain remarks regarding the international application

Date of filing of the application: 5 June 2000

Date of completion of this report: 2 January 2001

Fully authorized signatory: Kugler, D
Tel. No. 49 89 2999 2866

Name and address of the authority empowered
with the international preliminary examination:
European Patent Office
D-80298 Munich
Tel. 49 89 2399-0
Fax: 49 89 2399 - 4465

[Rubber Stamp]

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International File: PCT/EP99/08402

1. Basis of the Report

1. This report was drawn up on the basic specification (replacement pages which have been presented before the application office upon a request according to Article 14 are valid within the framework of this report as "originally filed" and are not to be found as attached thereto, because they include no modifications):

Description, pages:

7-11	original draft
1-6,5a	filed on 4 November 2000 with correspondence from 3 November 2000

Patent Claims, nos.:

1-11	filed on 4 November 2000 with correspondence from 3 November 2000
------	----------------------------------------------------------------------

Drawings, Pages:

1/4-4/4	original draft
---------	----------------

2. Regarding the **language**: All presently cited component parts have been drafted to fall within the authority of the wording of the language in which the international application has been filed, or have been made available or were filed in this wording, insofar as no different claims are included under this point.

The component parts fall under the authority of proper wording of the language: filed as made available or were filed in this language; thus it involves

// the language of the translation, which has been filed for the purposes of the international search (according to Rule 23.1(b)).

// the language of the publication of the international application (according to Rule 48.3(b)).

// the language of the translation, which has been filed for the purpose of the international preliminary examination (according to Rule 55.2 and/or 55.3).

3. Relating to the nucleotide- and/or amino acid sequence published in the international application, the international preliminary examination has been carried out on the basis of the sequence protocols, which:

// is included in the international application in written form.

// has been filed together with the international application in computer-readable form.

// has been filed with the authority in supplement in written form.

// has been filed with the authority in computer-readable form.

// The explanation that the filed, written sequence protocol filed as a supplement does not cover the content of the disclosure of the international application at the time the application was put before the authority.

// The explanation that the information included in computer-readable form corresponds to the sequence protocol was put before the authority.

4. Basis of the modifications, the following data are deleted:

// Description

// Claims

// Drawings

5. // this report has been presented without reference of any sort to the modifications, since these arise from the given bases according to the interpretation of the authority regarding the publication content in the originally filed draft (Rule 70.2(c)).
6. Additional remarks:

INTERNATIONAL PRELIMINARY EXAMINATION REPORT
International File PCT/EP/08402

V. Substantiated determination according to Article 35(2) relating to the novelty, the inventive concept and the commercial applicability; data and explanations in support of this determination

1. Determination

Novelty (N)	Yes:	Claims	1-11
	No:	Claims	
Inventive Concept (ET)	Yes:	Claims	1-11
	No:	Claims	
Commercial Applicability (GA)	Yes:	Claims	1-11
	No:		

2. Data and explanations

see Attached

**INTERNATIONAL PRELIMINARY EXAMINATION REPORT –
ATTACHMENT
INTERNATIONAL FILE**

PCT/EP99/08402

Regarding Part V:

Substantiated determination according to Article 35(2) relating to the novelty, the inventive concept and the commercial applicability; data and explanations in support of this determination

1.

Reference in the international search report is to the following cited documents:

- D0: EP-A-0 213 863 (SUPERIOR ELECTRIC CO) 11, March 1987 (1987-03-11)
- D1 EP-A-0 863 601 (MATSUSHITA ELECTRIC IND CO LTD) 9 September 1998 (1998-09-09)
- D2: US-A-4 224 543 (MORREALE ANTHONY P) 23 September 1980 (1980-09-23)

2.

Document D1 describes a device for converting from electric into mechanical energy with the features of the disclosure part of Claim 1. The known device has a plurality of coil windings arranged in circumferential layout, which are electrically connected over an end plate and with connection wires arranged in surrounding grooves. A connection wire is also guided from each connection distributor toward the exterior of the device.

The object of Claim 1 differs in the sense that the connection distributor of each connection group has two electrically conductive bands running in circumferential direction, which in turn are guided in one piece toward the exterior of the device and there together form a plug bushing for the electric contacting of the relevant connection group.

The object of Claim 1 is therefore novel. The requirements of Article 33(2) PCT are thus fulfilled.

3. None of the documents of the state of the art proposes a connection distributor which consists of two electrically conductive bands running in circumferential direction according to the disclosure of Claim 1. In document D1 the ends of adjacent connection wires of the same connection group which are adjacent to one another are pressed together with an associated winding end of the coil winding of the associated connection group. The connection toward the exterior is not made up of one piece therewith.

Documents D0 and D1 described a similar device, in which the end plate is constructed in the form of a conductor plate, by means of the connection surfaces of which the winding ends can be connected with one another and can be contacted on the exterior.

The object of Claim 1 is therefore of inventive concept. The requirements of Article 33(3) PCT are thus fulfilled.

The method for producing a device as in Claim 8 is assumed on the same basis likewise to be novel and of inventive concept.

4. The dependent Claims 2 to 7 and 9 to 11 are related back to the independent Claims 1 and 8. These claims likewise fulfill the requirements of Articles 33(2) and 33(3) PCT.

No objections are to be raised to counter the definition of commercial applicability of the object of Claims 1 to 11.

DEVICE FOR CONVERTING ELECTRIC ENERGY INTO A MECHANICAL ONE
AND/OR FOR DOING THE OPPOSITE AND METHOD FOR PRODUCING SUCH A
DEVICE

The invention relates to a device for converting electric energy into mechanical energy and/or the opposite according to the disclosure part of Claim 1 as well as a method for producing such a device.

A device as in the disclosure part of Claim 1 is known from EP 0 213 863 A2. This document shows a device connecting the winding ends of an electric motor, which is arranged in the form of an annular sheet bar with circumferential conductor paths and solder-connection surfaces at one axial end of the electric motor. The conductor paths and with them the winding ends can be contacted from the exterior either by connection pins projecting from the sheet bar or by means of connection conductors to be soldered to other solder-connection surfaces.

In the case of other known devices the ends of the windings which are the coil windings of the rotor and/or the stator stand at some acceptable distance over the coil windings and are guided in circumferential direction relative to a common point. There, the relevant ends of the windings are pressed together with one another, thus forming groups of connections, and then are provided with an electrical connection element. This requires costly and essentially manually executable laying out of the winding ends and also increases the dimensions of the structure, since the winding ends must be guided over the coil windings. Also, the connection between the connection device and the pressed-on winding ends, especially under environmental conditions which generate reactions thereto, represents a possible source of breakdown during operation of

MODIFIED PAGE

the device which has been produced, for example because of corrosion of the contacts.

EP 0 863 601 A1 shows a connection device for a stator in which connection wires forming connection distributors and being electrically insulating are embedded in circumferential grooves of an end plate fastened securely at the end of the stator. The ends of adjacent connection wires of the same group of connections which are turned toward one another are in turn pressed together with an associated winding end of the coil winding of the associated group of connections. To each connection distributor is guided a connection wire of the electric contact mechanism on the exterior of the device.

JP 6-233 483 A likewise shows a connection device for the electric connection of the winding ends of a group of connections of stator coil windings.

WO 97/26700 shows a connection device of a vehicle motor having connection plates of nonagon, annular format, arranged one over the other, to which the winding ends of the coil winding can be welded and which in turn have a crimp-connection for the crimp-connecting with a connection conductor leading toward the exterior. Each connection plate consists of a first electrically conductive layer and a second electrically insulating layer.

DE 195 44 830 A1 shows a stator for electric motors in which the winding ends of a connection group are connected with one another by electrically conducting connection distributors running in circumferential direction. The connection distributors have connection soldering lugs to which the winding ends or the motor connection conductors are welded or soldered.

US 4,224,543 shows a connection device for winding ends of stator coil windings with a sheet

bar

having radial notches to receive the ends of the winding and of external connection conductors, which subsequently are to be soldered with connection surfaces of the conductor paths mounted on the sheet bars.

US 5,806,169 shows a method for the production of an electric motor in which the stator is spray-injected and injection molded following the welding of the stator windings onto corresponding connection soldering lugs by means of an injection molding technique using a synthetic resin material.

The object of the invention is therefore to disclose a device to overcome the problem by using such a device, and an associated method of production of the device, which method and device overcome the drawbacks of the state of the art, particularly by incorporating small structural dimensions which guarantees high contact reliability with simple contacting and a long life and high current carrying capacity even under aggressive environmental conditions, and which can be manufactured simply.

The problem is solved by the device disclosed in Claim 1, as well as by the method which is disclosed in the other claims. Particular embodiments of the invention are disclosed in the dependent claims.

The device according to Claim 1 can be a motor or a generator, particularly a combined alternating or direct current-powered motor/generator device. Thus, coil windings could be arranged both on the rotor and on the stator, corresponding to the number of poles found on the device. The switch connection of the individual winding ends occurs according to the invention

MODIFIED PAGE

by means of a connection device with formation of connection groups or contact groups. With a three-phase alternating current device, for example, three (delta-wound circuit), four (star-wound circuit with spread-out star) or six connection or contact groups are formed. With six groups of connections, a switchover from star operation to three-phase operation and vice versa can also occur outside the device by suitable switching of the groups of connections. The rotor can be running on the interior or on the exterior in relation to the stator. A rotor having identical mass and running on the exterior has greater moments of inertia and torque. The connection distributor is guided toward the outside of the rotor or stator and there forms one piece with a connection device. This occurs preferably by suitable bending or shaping of a copper band or strip serving as connection distributor to a mechanical sleeve or bearing or plug element.

According to the one particular embodiment disclosed in Claim 2, the winding ends could advantageously be quite short. This leads not only to savings of material but also to small structural dimensions for the entire device. In the case of a rotor winding the rotor then has a slight imbalance which is a condition of this the type of construction.

According to the particular embodiment as in Claim 3, the connection distributors which may be annular in construction have cutting/clamping devices of one integral piece on the corresponding points at which the winding ends can be embedded, whereby the winding insulation is cut through at those points upon the pressing in of the winding ends. The cutting/clamping device in turn is preferably arranged precisely in relation to the associated winding ends. The cutting/clamping device can be set up ready for use by corresponding provision of a copper strip or copper ring to be used as connection distributor.

The particular embodiment of Claim 4 provides the two bands in essentially circular and coaxial alignment with the stator/rotor axis. Preferably a copper band or a copper strip is provided as connection distributor, whereby the band or strip is aligned parallel to the rotor or stator axis.

The two bands or strips are guided in one piece toward the exterior of the device and there form a bushing area for the connection device by means of complementary semi-circular bends. In the bushing area the band or strip width is aligned parallel to the longitudinal axis of a plug element to be plugged into the bushing.

According to the particular type of embodiment disclosed in Claim 5, in the bushing area the two bands are connected with one another by an elastic element, preferably connected by a corrugated retaining ring. A permanent contact reliability is thus guaranteed along with simultaneous high current-carrying capacity.

According to the particular type of embodiment disclosed in Claim 6, the connection distributors are arranged axially and radially one behind the other, whereupon the radial and/or axial structural dimensions of the device can be minimized. The particulars with reference to radial and/or axial arrangement are then referenced to the rotary axis of the device.

According to the particular embodiment as in Claim 7, by use of the receiving means, not only is an electric insulation of the connection distributors from one another guaranteed by the receiving means but also, by the provision of positioning means, for example cams on the receiving means and notches on the associated connection distributor, an exact peripheral positioning of the connection distributor in relation to the receiving means and correspondingly in relation to the device can be guaranteed. Thus, minimal connection paths between the connection distributor and the coil winding are guaranteed simultaneously with simple assembly. Of course the

connection distributors could also be fastened securely directly to the rotor and/or the stator without use of any receiving means.

With the method of the invention as in Claim 8, first of all the electrically conducting connection distributors are embedded in receiving means of the connection device, then the connection device fastened securely to the rotor or stator for example by bolting or pinning on, then further and subsequently the winding ends electrically connected with the associated connection distributors and finally in turn a plug bushing of the connection device formed of one piece with the bands guided toward the exterior of the device for the electric contacting of the connection groups to the exterior of the device. This step of the method could advantageously be made automatic and for example could be executed by industrial robots.

According to the type of embodiment disclosed in Claim 9, the winding ends can be connected with the associated connection distributors by means of a cutting/clamping device or by gluing, soldering or welding. Preferably high temperature-resistant electrically conductive adhesive substances are used for glue. Preferably the hard-soldering process is used for soldering. When using welding, spot-welding is preferred.

In the type of embodiment of Claim 10, the receiving means are sealed off with the embedded connection distributors, if necessary with use of a clamp collar. This preferably occurs by dipping in an electrically insulating synthetic resin. Then contact points for the electric connection with the ends of the windings remain accessible on the connection distributors. Alternatively to that, the contact points of the connection distributor provided with a cutting/clamping device could also be cast or filled in, since during the pressing in of the winding

ends the insulating layer is penetrated. This use of the procedure has the advantage that the connection device can be set up as a complete structural assembly in and of itself on the rotor or stator and can be completely assembled in one step.

According to the embodiment of Claim 11 the completely assembled and wired rotor or stator is cast in insulating material.

Other advantages, features and individual disclosures of the invention are disclosed by the dependent claims as well as the following description, in which a number of exemplary embodiments are described in some detail with reference to the attached drawings. Therefore the features mentioned in the claims and in the description could in turn be essential to the invention in and of themselves or in any desired combination.

- Fig. 1 shows a cross section through a device according to the invention,
- Fig. 2 shows a plan view of the stator of Fig. 1,
- Fig. 3 shows the electric wiring of the coil windings,
- Fig. 4 shows a section corresponding to the line IV-IV of Fig. 2,
- Fig. 5 shows a section along the line V-V of Fig. 2,
- Fig. 6 shows a cross section along the line VI-VI of Fig. 2,
- Fig. 7 shows an alternative embodiment of the device,
- Fig. 8 shows an enlarged section of Fig. 7 in the area of the connection distributors, and

Patent Claims

1. Device for converting electric energy into mechanical energy and/or vice versa with a rotor (4) and a stator (2), particularly a combined motor/generator device (1), wherein coil windings (6) having at least two winding ends (17a, 17b; 18a, 18b; 19a, 19b) are arranged on the rotor (4) and/or the stator (2) in turn having a circumferential layout direction (13) following one after the other, and the winding ends (17a, 17b; 18a, 18b; 19a, 19b) of the various coil windings (6a; 6b; 6c) are electrically connected with one another with formation of groups of connections, whereby the device includes a connection device (7, 8, 9, 10) for the connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) of a group of connections with electrically conductive connection distributors (8, 9, 10) running in circumferential direction, which form a connection device and are guided in one piece toward the exterior of the device, by means of which the relevant groups of connections can be electrically contacted outside the device, **characterized in that** the connection distributors (8, 9, 10) of each connection group have two electrically conductive bands (8a, 8b; 9a, 9b; 10a, 10b) which in turn are guided in one piece toward the exterior of the device and there together form a plug bushing (14; 15; 16) for the electric contacting of the relevant groups of connections.
2. Device as in Claim 1, characterized in that each winding end (17a, 17b; 18a, 18b; 19a, 19b) is connected with the associated connection distributor (8, 9, 10) in the close vicinity of the relevant coil winding (6a, 6b, 6c).
3. Device as in one of the Claims 1 or 2, characterized in that the connection distributors (8,

9, 10) have a cutting/clamping device (21';121) configured of one piece for the electric connection with the associated winding ends (17a, 17b; 18a, 18b; 19a, 19b).

4. Device as in one of the Claims 1 to 3, characterized in that the two bands (8a, 8b; 9a, 9b; 10a, 10b) run essentially in semi-circles in circumferential direction.
5. Device as in Claims 1 to 4, characterized in that the two bands (110a, 110b) in the mechanical sleeve or bearing area (114) are connected by an elastic or flexible element, preferably by a corrugated retaining ring (124).
6. Device as in one of the Claims 1 to 5, characterized in that the bands (8a, 8b; 9a, 9b; 10a, 10b) of the individual groups of connections are arranged axially one behind the other, or are of different diameters and are arranged concentrically radially one behind the other.
7. Device as in one of the Claims 1 to 6, characterized in that the connection distributors (8, 9, 10) are arranged electrically insulated from one another in a receiving means (7) of the connection device (7, 8, 9, 10) which can be axially and/or radially securely mounted on the rotor (4) and/or the stator (2).
8. Method for producing a device as in one of the Claims 1 to 7, with the following steps:
 - embedding of the electrically conductive bands (8a, 8b; 9a, 9b; 10a, 10b) of the connection distributors (8, 9, 10) in a receiving means (7) of the connection device (7, 8, 9, 10) in such a manner that the connection distributors (8, 9, 10) not belonging to a common group of connections are electrically insulated from one another,
 - tight fastening of the connection device (7, 8, 9, 10) to the rotor (4) and/or the stator (2),
 - electric connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) with the associated connection distributors (8, 9, 10), and
 - forming in turn of a plug bushing (14; 15; 16) of the connection device of one

piece out of the bands (8a, 8b; 9a, 9b; 10a, 10b) guided in one piece to the exterior of the device, these bands being part of a group of connections for the electric contacting of the relevant group of connections to the exterior of the device.

9. Method as in Claim 8, characterized in that the electric connection of the winding ends (17a, 17b; 18a, 18b; 19a, 19b) with the associated connection distributors (8, 9, 10) occurs in the close vicinity of the relevant coil winding (6a, 6b, 6c) by insertion in turn in a cutting/clamping device (21) provided on the connection distributors (8, 9, 10) and preferably of one piece, or by gluing, soldering or welding.
10. Method as in Claim 8 or 9, characterized in that the receiving means (7) are sealed together with the embedded connection distributors (8, 9, 10), preferably by dipping in an electrically insulating synthetic resin, whereby preferably following the sealing off, contact points are accessible on the connection distributors (8, 9, 10) for the electric connection with the winding ends (17a, 17b; 18a, 18b; 19a, 19b).
11. Method as in Claim 8 or 9, characterized in that the rotor (4) or the stator (2) together with the connection device (7, 8, 9, 10) sealed onto it and connected with the winding ends (17a, 17b; 18a, 18b; 19a, 19b) is then sealed off, preferably by dipping in an electrically insulating synthetic resin.

1 / 4

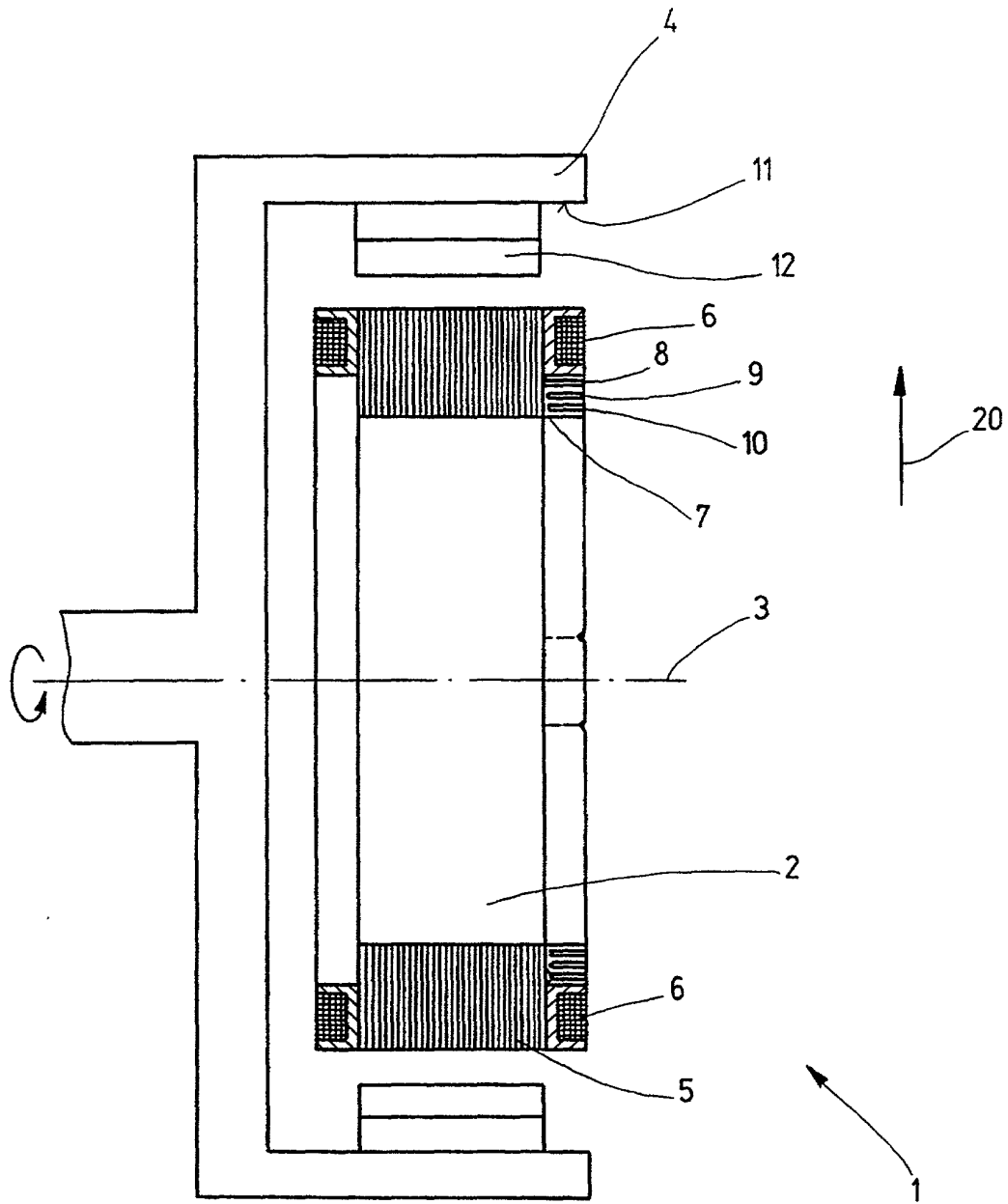
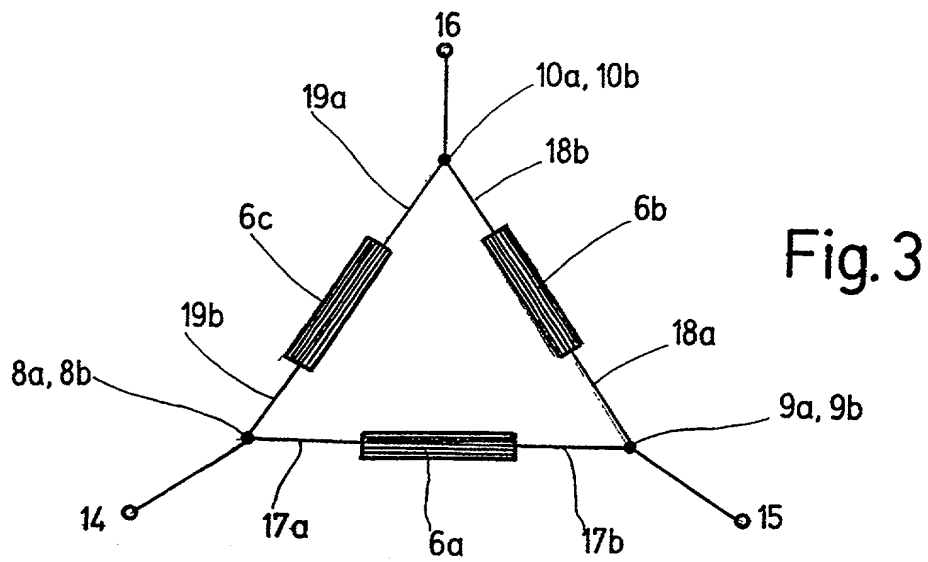
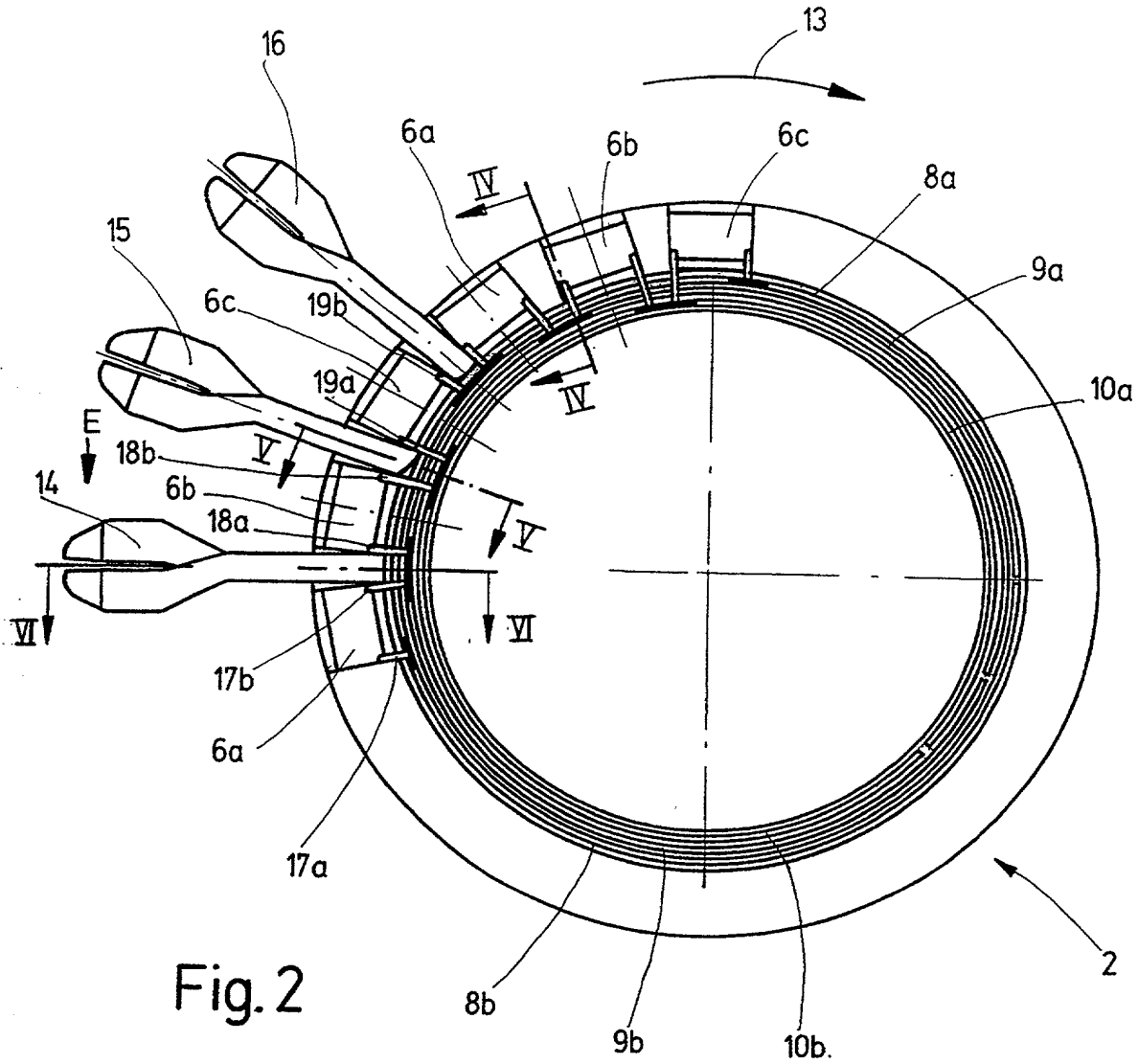
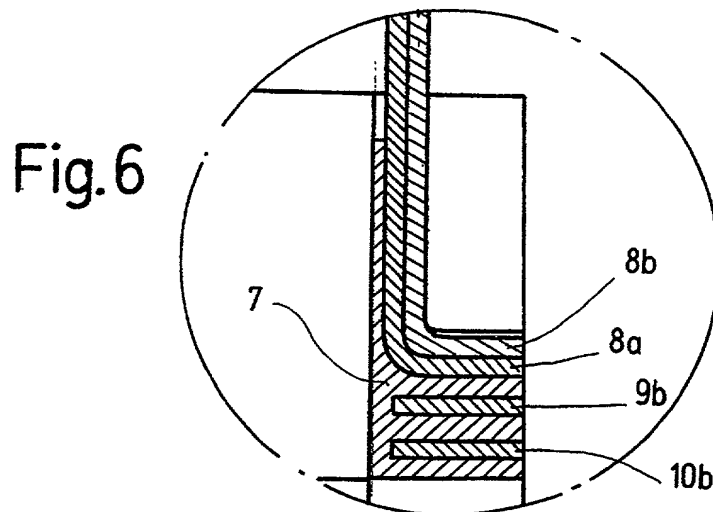
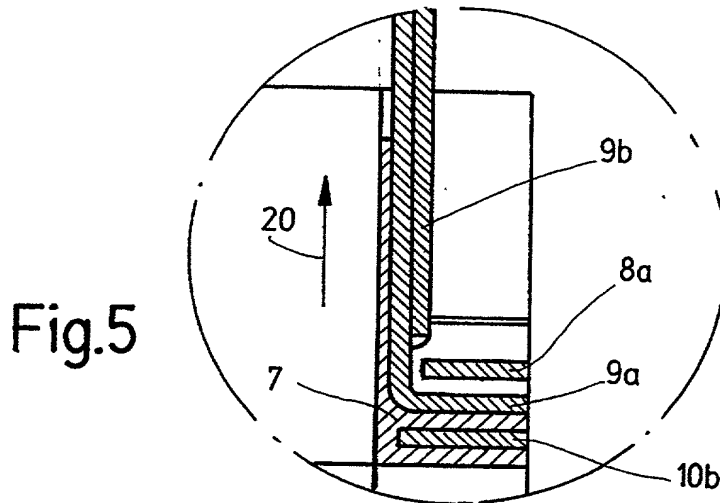
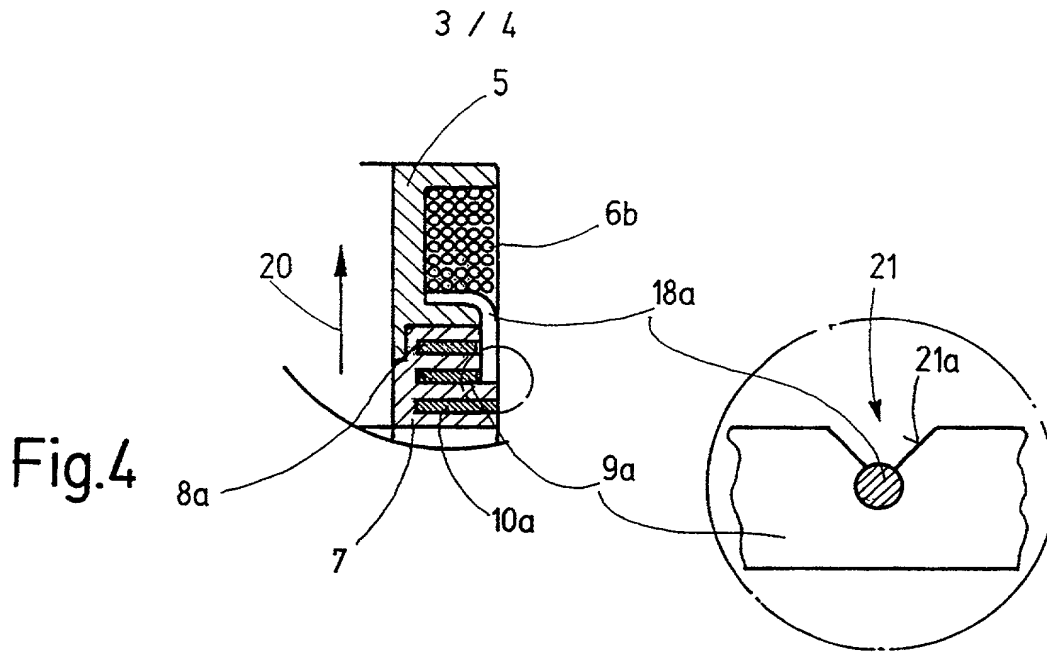


Fig. 1





4 / 4

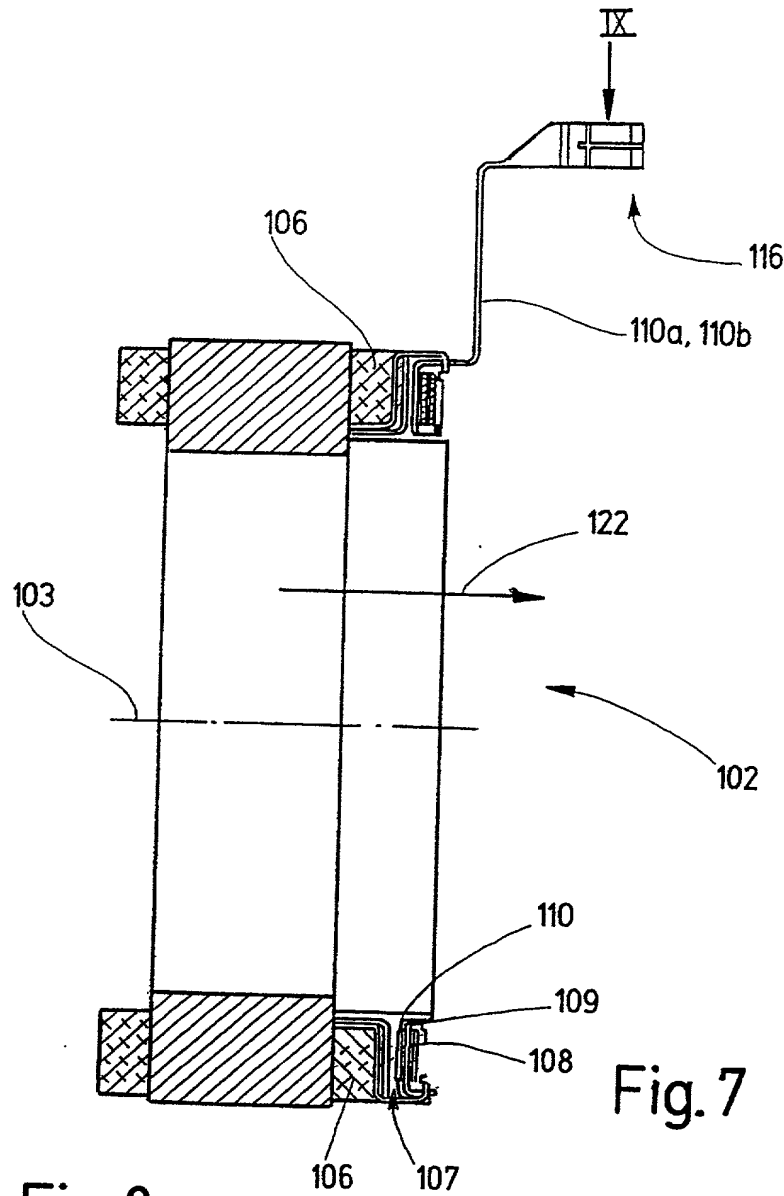


Fig. 7

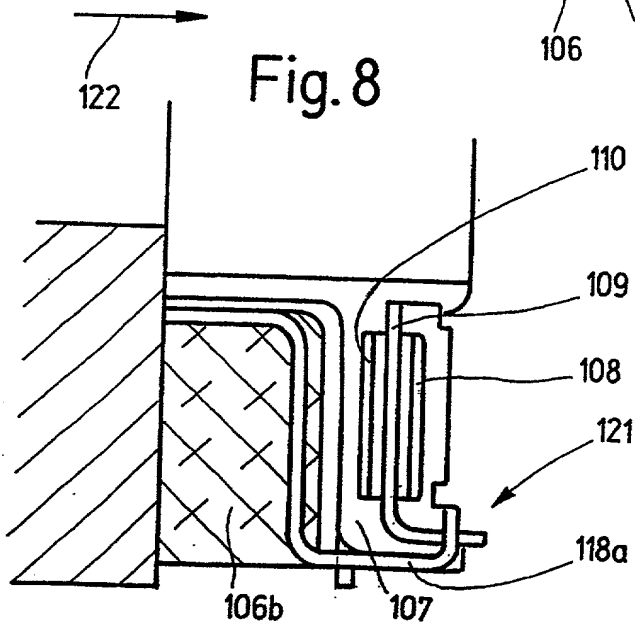


Fig. 8

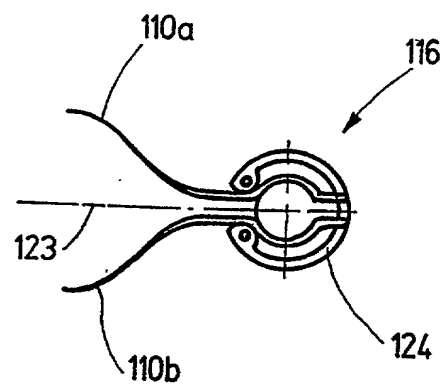


Fig. 9

Declaration and Power of Attorney for Patent Application

Erklärung für Patentanmeldungen mit Vollmacht

German Language Declaration

Als nachstehend benannter Erfinder erkläre ich hiermit an Eides Statt:

daß mein Wohnsitz, meine Postanschrift und meine Staatsangehörigkeit den im nachstehenden nach meinem Namen aufgeführten Angaben entsprechen, daß ich nach bestem Wissen der ursprüngliche, erste und alleinige Erfinder (falls nachstehend nur ein Name angegeben ist) oder ein ursprünglicher, erster und Miterfinder (falls nachstehend mehrere Namen aufgeführt sind) des Gegenstandes bin, für den dieser Antrag gestellt wird und für den ein Patent für die Erfindung mit folgendem Titel beantragt wird:

deren Beschreibung hier beigelegt ist, es sei denn (in diesem Falle Zutreffendes bitte ankreuzen), diese Erfindung

- ☐ wurde angemeldet am _____ unter der US-Anmeldenummer oder unter der Internationalen Anmeldenummer im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) _____ und am _____ abgeändert (falls zutreffend).

Ich bestätige hiermit, daß ich den Inhalt der oben angegebenen Patentanmeldung, einschließlich der Ansprüche, die eventuell durch einen oben erwähnten Zusatzantrag abgeändert wurde, durchgesehen und verstanden habe.

Ich erkenne meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Titel 37, Code of Federal Regulations, § 1.56 von Belang sind.

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated next to my name.

I believe I am the original, first and sole inventor (if only one name is listed below) or an original, first and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

DEVICE FOR CONVERGING ELECTRIC ENERGY INTO A

MECHANICAL ONE AND/OR FOR DOING THE OPPOSITE

AND METHOD FOR PRODUCING SUCH A DEVICE

the specification of which is attached hereto unless the following box is checked:

- ☒ was filed on November 3, 1999 as United States Application Number or PCT International Application Number PCT/EP99/08402 and was amended on _____ (if applicable).

I hereby state that I have reviewed and understand the contents of the above identified specification, including the claims, as amended by any amendment referred to above.

I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56.

Under the Paperwork Reduction Act of 1995, no persons are required to respond to a collection of information unless it displays a valid OMB control number

German Language Declaration

Ich beanspruche hiermit ausländische Prioritätsvorteile gemäß Title 35, US-Code, § 119 (a)-(d), bzw. § 365(b) aller unten aufgeführten Auslandsanmeldungen für Patente oder Erfinderurkunden, oder § 365(a) aller PCT internationalen Anmeldungen, welche wenigstens ein Land ausser den Vereinigten Staaten von Amerika benennen, und habe nachstehend durch ankreuzen sämtliche Auslandsanmeldungen für Patente bzw. Erfinderurkunden oder PCT internationale Anmeldungen angegeben, deren Anmeldetag dem der Anmeldung, für welche Priorität beansprucht wird, vorangeht.

Prior Foreign Applications
(Frühere ausländische Anmeldungen)

198 50 818.2 DE
(Number) (Country)
(Nummer) (Land)

(Number) (Country)
(Nummer) (Land)

Ich beanspruche hiermit Prioritätsvorteile unter Title 35, US-Code, § 119(e) aller US-Hilfsanmeldungen wie unten aufgezählt.

(Application No.) (Filing Date)
(Aktenzeichen) (Anmeldetag)

(Application No.) (Filing Date)
(Aktenzeichen) (Anmeldetag)

Ich beanspruche hiermit die mir unter Title 35, US-Code, § 120 zustehenden Vorteile aller unten aufgeführten US-Patentanmeldungen bzw. § 365(c) aller PCT internationalen Anmeldungen, welche die Vereinigten Staaten von Amerika benennen, und erkenne, insofern der Gegenstand eines jeden früheren Anspruchs dieser Patentanmeldung nicht in einer US-Patentanmeldung, bzw. PCT internationalen Anmeldung in in einer gemäß dem ersten Absatz von Title 35, US-Code, § 112 vorgeschriebenen Art und Weise offenbart wurde, meine Pflicht zur Offenbarung jeglicher Informationen an, die zur Prüfung der Patentfähigkeit in Einklang mit Title 37, Code of Federal Regulations, § 1.56 von Belang sind und die im Zeitraum zwischen dem Anmeldetag der früheren Patentanmeldung und dem nationalen oder im Rahmen des Vertrags über die Zusammenarbeit auf dem Gebiet des Patentwesens (PCT) gültigen internationalen Anmeldetags bekannt geworden sind.

(Application No.) (Filing Date)
(Aktenzeichen) (Anmeldetag)

(Application No.) (Filing Date)
(Aktenzeichen) (Anmeldetag)

Ich erkläre hiermit, daß alle in der vorliegenden Erklärung von mir gemachten Angaben nach bestem Wissen und Gewissen der Wahrheit entsprechen, und ferner daß ich diese eidesstattliche Erklärung in Kenntnis dessen ablege, daß wissentlich und vorsätzlich falsche Angaben oder dergleichen gemäß § 1001, Title 18 des US-Code strafbar sind und mit Geldstrafe und/oder Gefängnis bestraft werden können und daß derartige wissentlich und vorsätzlich falsche Angaben die Rechtswirksamkeit der vorliegenden Patentanmeldung oder eines aufgrund deren erteilten Patentes gefährden können.

I hereby claim foreign priority under Title 35, United States Code, § 119(a)-(d) or § 365(b) of any foreign application(s) for patent or inventor's certificate, or § 365(a) of any PCT International application which designated at least one country other than the United States, listed below and have also identified below, by checking the box, any foreign application for patent or inventor's certificate, or PCT International application having a filing date before that of the application on which priority is claimed.

Priority Not Claimed
Priorität nicht beansprucht

4 November 1998
(Day/Month/Year Filed)
(Tag/Monat/Jahr der Anmeldung)



(Day/Month/Year Filed)
(Tag/Monat/Jahr der Anmeldung)



I hereby claim the benefit under Title 35, United States Code, § 119(e) of any United States provisional application(s) listed below.

I hereby claim the benefit under Title 35, United States Code, § 120 of any United States application(s), or § 365(c) of any PCT International application designating the United States, listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States or PCT International application in the manner provided by the first paragraph of Title 35, United States Code, § 112, I acknowledge the duty to disclose information which is material to patentability as defined in Title 37, Code of Federal Regulations, § 1.56 which became available between the filing date of the prior application and the national or PCT International filing date of this application.

(Status) (patented, pending, abandoned)
(Status) (patentiert, schwebend, aufgegeben)

(Status) (patented, pending, abandoned)
(Status) (patentiert, schwebend, aufgegeben)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

German Language Declaration

VERTRETUNGSVOLMACHT: Als benannter Erfinder beauftrage ich hiermit den (die) nachstehend aufgeführten Patentanwalt (Patentanwälte) und/oder Vertreter mit der Verfolgung der vorliegenden Patentanmeldung sowie mit der Abwicklung aller damit verbundenen Angelegenheiten vor dem US-Patent- und Markenamt: (Name(n) und Registrationsnummer(n) auflisten)

POWER OF ATTORNEY: As a named inventor, I hereby appoint the following attorney(s) and/or agent(s) to prosecute this application and transact all business in the Patent and Trademark Office connected therewith: (list name and registration number)

David S. Abrams Reg. No. 22,576 Lance G. Johnson Reg. No. 32,531
 Robert H. Berdo Reg. No. 19,415 Dean H. Nakamura Reg. No. 33,981
 Alfred N. Goodman Reg. No. 26,458 Stacey J. Longanecker Reg. No. 33,952
 Mark S. Bicks Reg. No. 28,770 Joseph J. Buczynski Reg. No. 35,084
 John E. Holmes Reg. No. 29,392
 Garrett V. Davis Reg. No. 32,023

Postanschrift:

Send Correspondence to:

Mark S. Bicks, Roylance, Abrams, Berdo & Goodman, L.L.P.
 1300 19th Street N.W., Suite 600 Wash, D.C. 20036

Telefonische Auskünfte: (Name und Telefonnummer)

Direct Telephone Calls to: (name and telephone number)

Mark S. Bicks (202) 659-9076

Vor- und Zuname des einzigen oder ersten Erfinders	Full name of sole or first inventor	Erich Walter Frank
Unterschrift des Erfinders	Inventor's signature	ERF Date 12.4.2001
Datum		
Wohnsitz	Residence	Hochdorf, Germany DEX
Staatsangehörigkeit	Citizenship	German
Postanschrift	Post Office Address	Bachstrasse 50
		D-73269 Hochdorf, Germany
Vor- und Zuname des zweiten Miterfinders (falls zutreffend)	Full name of second joint inventor, if any	
Unterschrift des zweiten Erfinders	Second Inventor's signature	Date
Datum		
Wohnsitz	Residence	
Staatsangehörigkeit	Citizenship	
Postanschrift	Post Office Address	

(Im Falle dritter und weiterer Miterfinder sind die entsprechenden Informationen und Unterschriften hinzuzufügen.)

(Supply similar information and signature for third and subsequent joint inventors.)